MA-550

DUAL CHANNEL

PROGRAMMABLE POWER AMPLIFIER

INSTRUCTION MANUAL

tau-tron
A UNIT OF
GENERAL SIGNAL

tau-tron
inc
27 Industrial Ave., Chelmsford, MA 01824
Tel: (617) 256-9013 TWX: 710-343-6781

MA-550

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SECTION 1

GENERAL DISCRIPTION

The MA-550 is a dual channel general purpose wide-band amplifier packaged in one-quarter TMI size module.

The MA-550 on each output is capable of driving a 50 ohm terminated coaxial cable in excess of 550 MHz with minimum pulse width of 900 pico-seconds. Rise/fall times are typically 400 ps.

Each channel (data and $\overline{\text{data}}$) is simultaneously variable from 300 mV to 1.2 V peak to peak and base line offset voltage of -1.8 V to +1 V range.

Input threshold level can be varied within the range of ±1.3 V. Input termination voltage can be selected by means of internal pc board mounted slide switch for the most commonly used 50 ohm to ground or -2 V termination cases.

High speed amplifier circuits are fablicated with Tau-Tron's thin-film hybrid microcircuits.

SECTION 2
SPECIFICATIONS

Unless otherwise noted, the following apply to each of the two channels and all outputs are terminated by 50 ohms DC to ground.

2.1 DYNAMIC CHARACTERISTICS

Minimum Pulse Width --- 900 ps.

Data Rate --- DC to 550 MHz.

Aberrations --- 150 mv peak to peak or 9%, whichever is greater, on all four corners.

Propagation Delay --- 4 ns ±1 ns for any input to output (s); 200 ps maximum data output to complemented output. 1 ns maximum between CH-1 and CH-2 outputs.

2.2 INPUTS (including Common Input and Common Gates)

Level --- 50 ohms to ground or -2V selectable. Switches are mounted on the pc board. 1.1 V p.p. max., .6 V p.p. min.

The threshold level can be varied ± 1.3V range by means of screwdriver adjustable potentiometer mounted on the front panel.

2.3 OUTPUT (DATA and DATA)

Amplitude --- 300 mV to 1.2 V continuously variable.

Offset --- Continuously variable over the range -1.8V to +1V.

Output Termination --- 50 ohms DC ±5% to ground. Unused output must be terminated.

Output Protection --- Short circuit to ground or to ±3 volts.

Rise/Fall Times --- 1 ns max., 500 ps typ. (10% - 90%) ±7% max. distortion when driving a 50 ohm DC load.

2.4 PHYSICAL

Quarter-size TMI module.

SECTION 3

OPERATIONS

3.1 The necessary power of the MA-550 is supplied by the MF-2 mainframe and no additional power supply is required.

3.2 I/O controls: Figure 3.1 and Figure 3.2 shows all the I/O controls and indicators.

3.3 INPUTS

A. Selection of the input termination voltage depends on the characteristics of the driving source. Selection is by means of slide switches mounted on the pc board as shown in Figure 3.2.

Also front panel LED indicates the selected termination voltage.

B. Threshold level can be varied ±1.3 volt range by the screw driver adjustable potentiometer on the front panel.

3.4 OUTPUT

A. It is important that all outputs MUST BE terminated by 50 ohms to ground, including unused channels.

B. The output waveforms will be deterated by the poor termination, cable impedance other than 50 ohms.

C. If the quality output signal is to be examined, at least 2 GHz or higher sampling scope* must be used due to fast transition of the output signal even though its repetition rate is slow.

* Tektronics 7904 mainframe, 7S11, with S-2 and 7T11 plug-ins. HP, 182C sampling scope or equivalent.

D. True and complement outputs can be simultaneously varied the specified ranges by means of the output amplitude and offset controls which knobs are mounted on the front panel.

Figure 3.1 FRONT PANEL VIEW

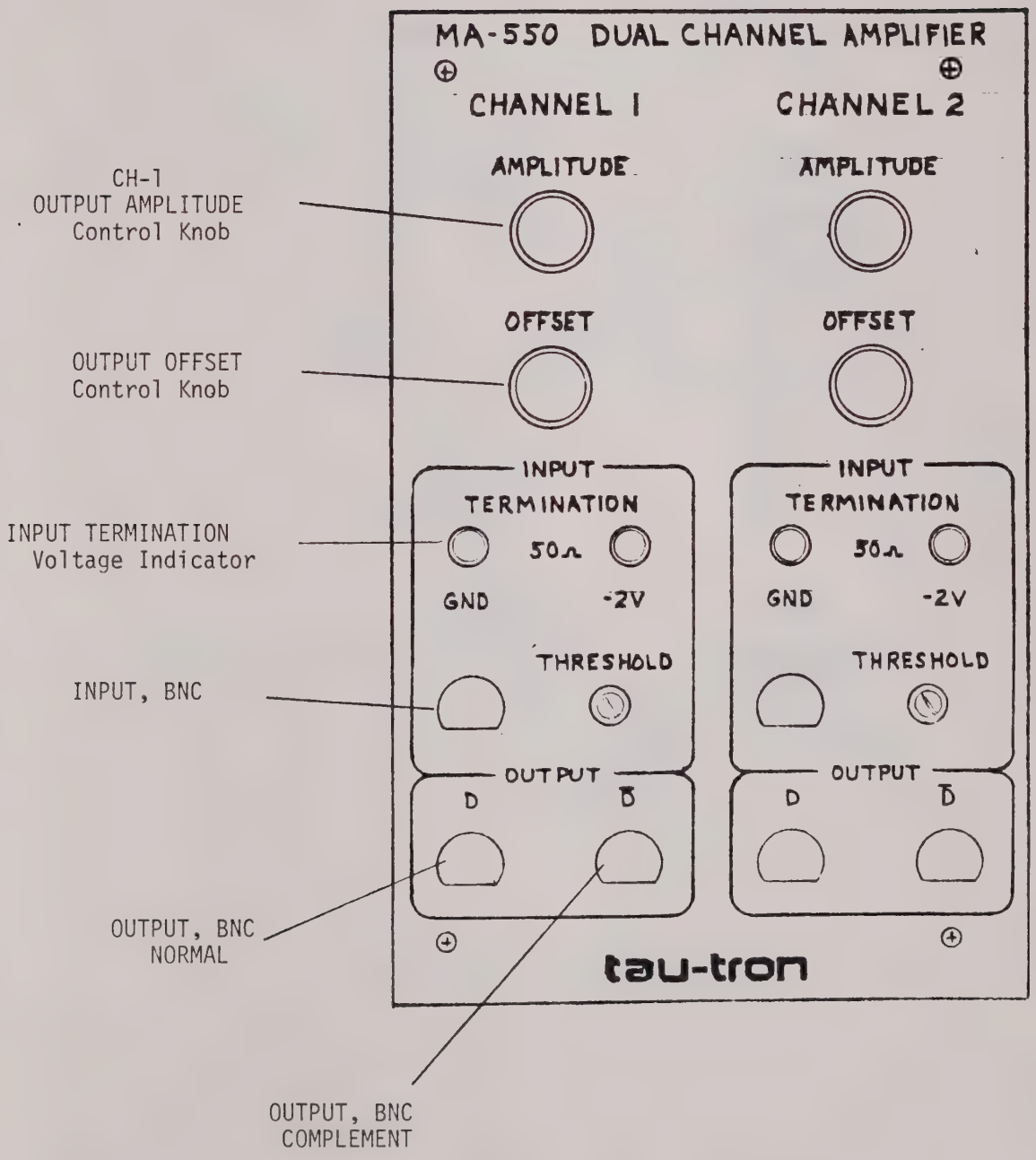
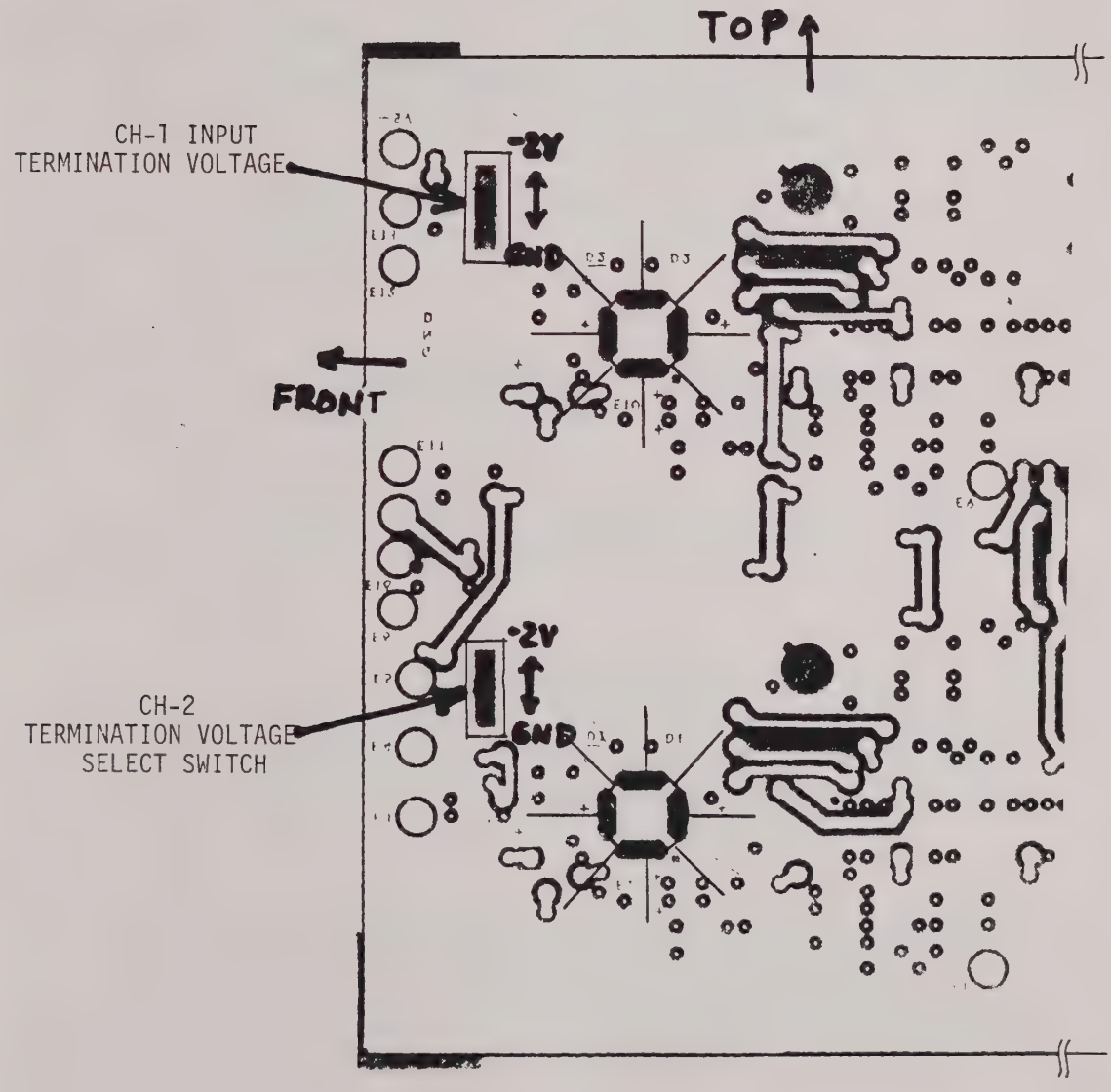


FIGURE 3.2 TERMINATION VOLTAGE SELECT SW LOCATION



SECTION 4
CIRCUIT DESCRIPTIONS

4.1 FUNCTIONAL BLOCK DIAGRAM

As shown in the attached Functional Block Diagram, the MA-550 contains two identical amplifier channels with common power supply.

Each channel consists of input circuit, output hybrid amplifier and output level control circuit.

4.2 INPUT CIRCUIT

The Tau-Tron's microcircuit, MA-550M requires standard ECL level at the input as a differential or single ended input circuit.

Pin 3 of the MA-550M is about -1.3 V of threshold level and Pin 2 is a data input which is connected to the input connector via variable level translation circuit.

The AC and DC coupled circuit yields wide bandwidth frequency response with variable DC offset capability. The IC-2 OP Amps are connected as a DC restoring circuit across the AC coupled capacitor. R-6 trim pot will be adjusted for optimum drooping compensaation across the by-pass cap.

4.3 OUTPUT HYBRID

The major high-frequency performance is achieved by the MA-550M thin-film microcircuit. A multi-stage differential circuit acting as a saturated switch is used. Pins 8 and 7 are data and complemented outputs respectively and each 50 ohms cables are connected to the front BNC connectors.

Pins 10 and 6 are amplitude and output baseline offset control pins which control voltages are driven form power operational amplifier IC-4 and IC-5.

Pins 12 and 4 of the MA-550 are provided to maintain quality waveforms over the wide output voltage program.

4.4 CONTROL CIRCUIT

A. Amplitude control signal is provided by a front panel mounted potentiometer and fed to a OP Amp IC-4. R-4 is also provided to set minimum amplitude control voltage when front panel knob is placed on "MIN" position. Typical output voltage range of the IC-4 is +4 to +9 V.

B. Base-line offset control circuit is similar to the amplitude control circuit but the IC-5 produces bipolar and its typical output voltage range is -6 V to +2 V.

C. IC-3 and IC-2 are used as a waveform compensation circuit. The output of IC-3 is a function of the amplitude/offset controls and its compensation voltage is adjusted under dynamic trimming condition.

Pin 4 of the MA-550M is used only for the output waveform distortion vs amplitude change. The Q1 is used as a current booster for IC-2 and its emitter voltage is -3 V to -6 V range typical.

4.5 POWER SUPPLY

The circuit requires ±12 V, +8 V and -5.2 V to operate. The ±34 raw DC voltages are supplied by the MF-2 mainframe. Two regulators are mounted on the back panel of the MA-550 module and generate ±12 V. Two voltages are supplied to the pc board. +8 and -5.2 V are generated by on-board regulators IC-11 and IC-12 from the +12 and -12 V respectively.

SECTION 5
CALIBRATION

5.1 The module is supplied to the customer fully calibrated and does not normally require periodic calibration. The following calibration procedure applies to each channel of amplifier independently. Unless otherwise noted, all measurements are made at the output amplifier. The MA-550 unit must be taken out of mainframe and power extension cable (model EC-1) will be used. Since the transition speed of 400 ps over 1 GHz is expected from the MA-550 independent of repetition rate and the poor low frequency response of the sampling scope, both sampling and real time scope is needed to examine wide dynamic response.

A 10 to 1 attenuator is recommended to use at the input of the scope.

5.2 OUTPUT LEVEL ADJUST Refer to component loading diagram #TCK-54151.

A. Initial Set-Up
   1. Set input pulse width of about 10 ns or wider data rate.
   2. Set input bias level to proper level so that output pulse width is same as the input data.

B. R-4, Amplitude Minimum Voltage Set (R10 for the CH-2)
   1. Set AMP control knob to full counterclockwise (min).
   2. Set the out signal about zero volt baseline.
   3. Adjust the R-4 for 300 mV peak-to-peak output.
   4. Turn the AMP control knob in full CW (max) and check maximum output voltage of 1.2 minimum.

C. R-5, Offset Positive Limit Set (R-11 for the CH-2)
   1. Set AMP control about 1 V peak-to-peak.
   2. Set OFFSET control knob in full CW.
   3. Adjust the R-5 for output baseline of +1 V offset.

4. Turn OFFSET control to full CCW and check the most negative range of -1.8 V.

5.3 DYNAMIC WAVEFORM COMPENSATIONS

In this procedure, test diagram the Figure 5.1 must be used along with attached loading diagram.

A. Initial Set-Up --- Same as paragraph 5.2A.

B. R-1, REF. ADJ. (R-7 for the CH-2)
1. Set the output amplitude about 300 mV p-p (mm).
2. Set the output baseline offset of +1 (full CW).
3. Adjust the R-1 for the best compromise waveform against rise/fall time, over-shoot/ringing, width distortion. This step will be repeated several times.

C. R-2, OFFSET Compensation (R-8 for the CH-2)
1. Set the output amplitude about 300 mV p-p (min).
2. Change the output baseline from +1 V to -1.5 V range with the offset control, and observe the output waveform distortion vs offset voltage changes.
3. Adjust the R-2 for the minimum waveform change at -1.5 V baseline output conditions.

D. R-3, AMP Compensation (R-9 for the CH-2)
1. Set OFFSET control knob in full CW.
2. Change the output amplitude from minimum position to maximum and observe the output waveform vs amplitude change.
3. Adjust the R-3 for the minimum distortion at maximum output amplitude level.

5.4 R-6, DC restoring circuit adjustment (R12 is for the CH-2)
1. Initial Set-Up --- Set the input data rate of 1 KHz or lower. Probe Pin 2 of the MA-550M hybrid microcircuit. 2.5 k ohms or higher probe with real time scope is recommended.

Set the INPUT BIAS control to mid-point.

2. Adjust R-6 (R-12) for the best averaged flatness from the drooping.

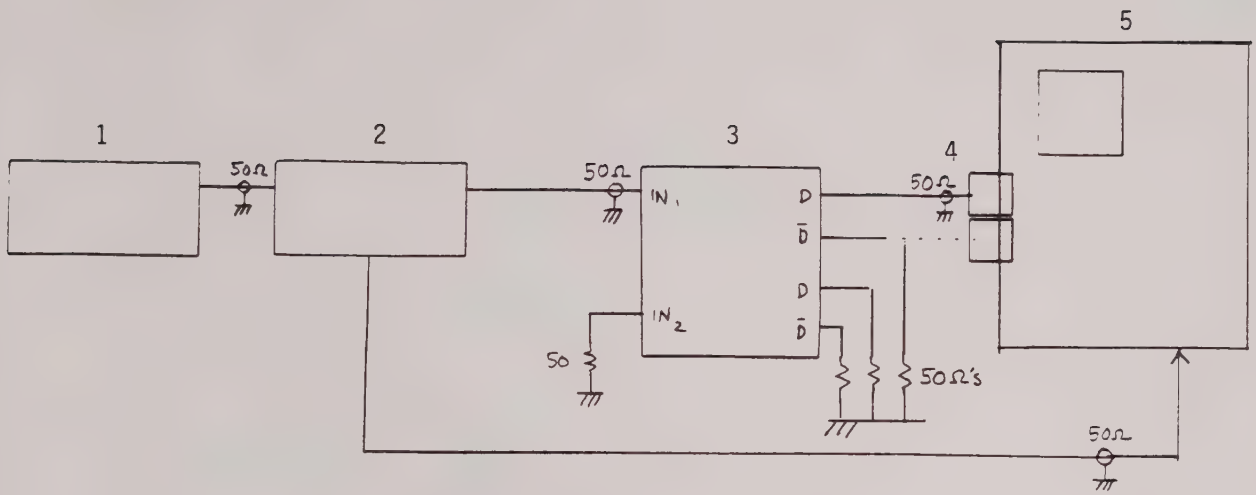


FIGURE 5.1 MA-550 TEST DIAGRAM

Note:

1. Variable Clock Source ---------- 1 KHz 550 MHz.
2. Data Generator, Tau-Tron MG-15
   Tau-Tron STX-1001
3. MA-550, Unit Under Test
4. 10:1 Attenuator
5. Tektronix, 7409 Mainframe
   TS11, 7T11, Sampling Plug-ins
   7A26 and 7B92, 200 MHz Real Time Plug-ins.

SECTION 6

LIST OF ILLUSTRATIONS

MA-550 Functional Block Diagram TBN-54157

MA-550 Schematic TDJ-54152

MA-550 Loading Diagram (Trim Pots Location Dwg) TDK-54151

Power Supply Module, Schematic TAJ-54148

tau-tron
inc
11 Esquire Road, North Billerica, Mass. 01862
Tel: (617) 667-3874 TWX: 710-347-1570

INSPECTION

1. MECHANICAL

If any damage is observed on the shipping carton, ask that the carrier's agent be present during unpacking. In the event that any external damage is found on the instrument, notify the carrier and Tau-Tron as soon as possible. Follow claims procedure below.

2. ELECTRICAL

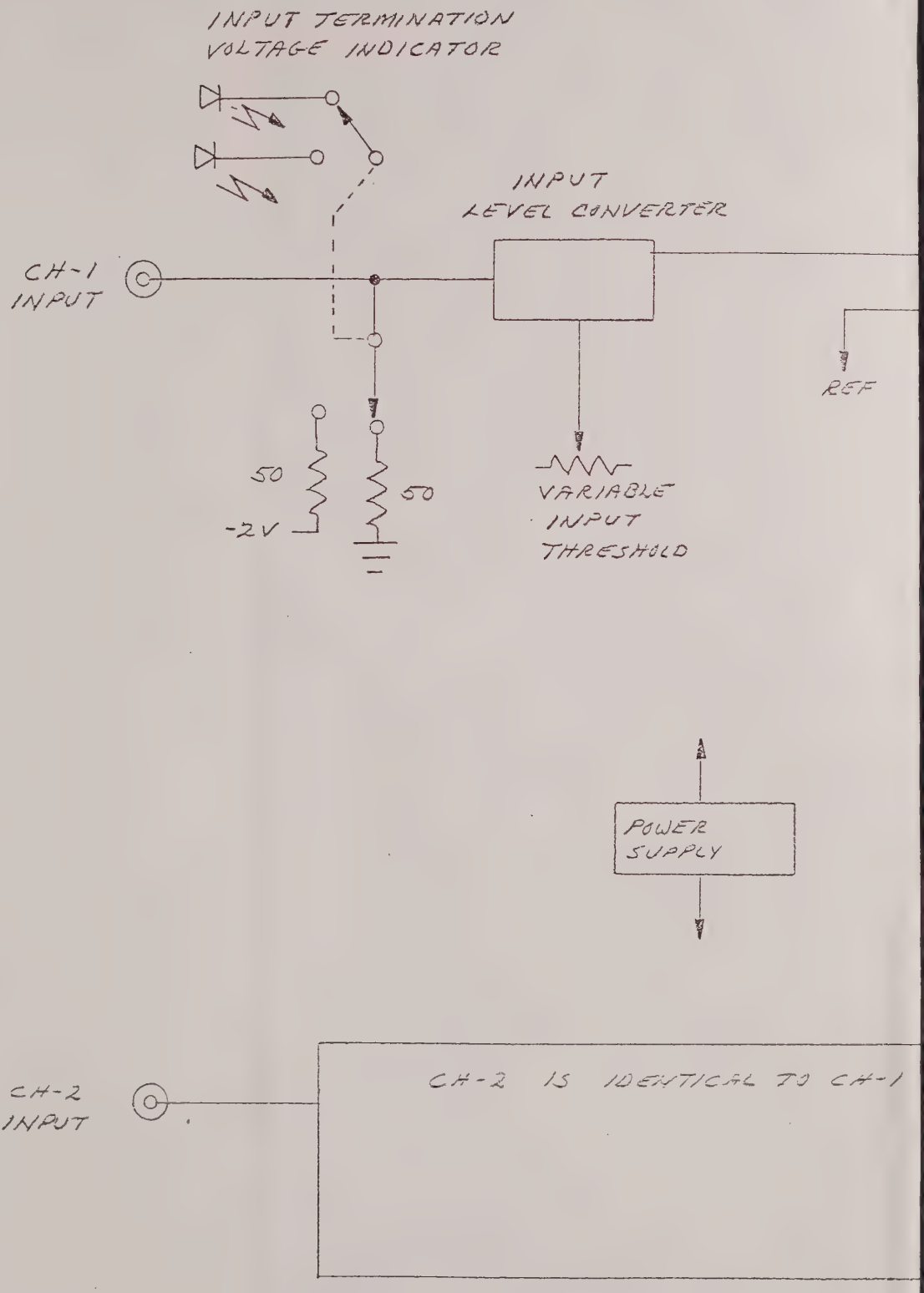
Check out the electrical performance of the instrument as soon as possible after receipt. Should any malfunctions be observed, follow the claims procedure below.

3. CLAIMS

If the unit has mechanical damage or fails electrical check-out, notify Tau-Tron immediately. For mechanical damage which occurred during shipment, notify the carrier also. The Tau-Tron Customer Service Department will arrange for repair or replacement of the instrument. A Return Authorization number will be issued for all returns.

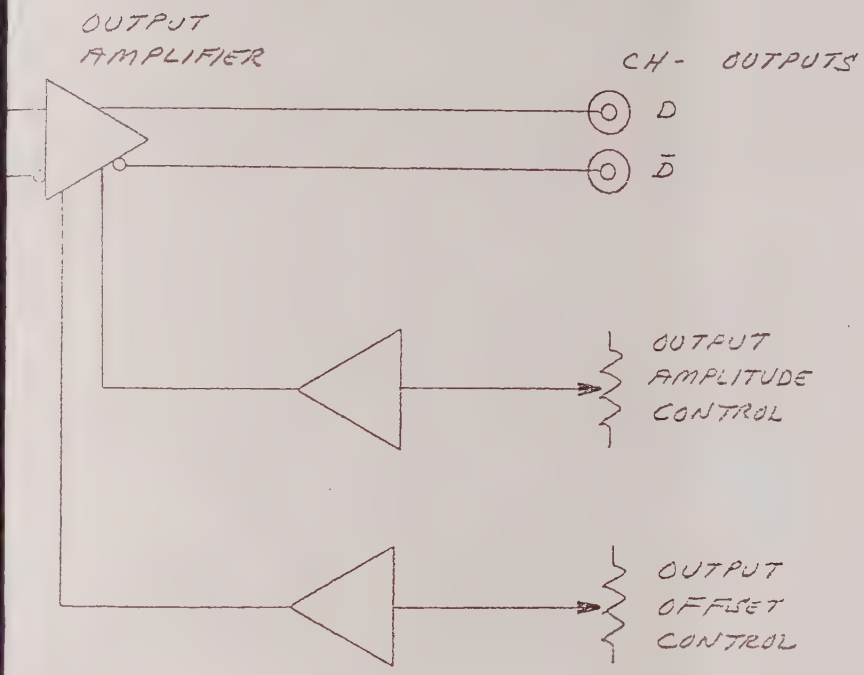
4. REPACKAGING

Use the original shipping carton and materials, if available. Otherwise use a double-walled carton (test strength of 350 pounds), and shock absorbing material such as bubble-wrap to prevent instrument from moving in the shipping carton during transit. Secure package by sealing with heavy paper tape.



BRUNING 40-21

DATE	SYM	REVISION RECORD	DR.	CK.



TOLERANCES (EXCEPT AS NOTED)	TAU-TRON, INC.		
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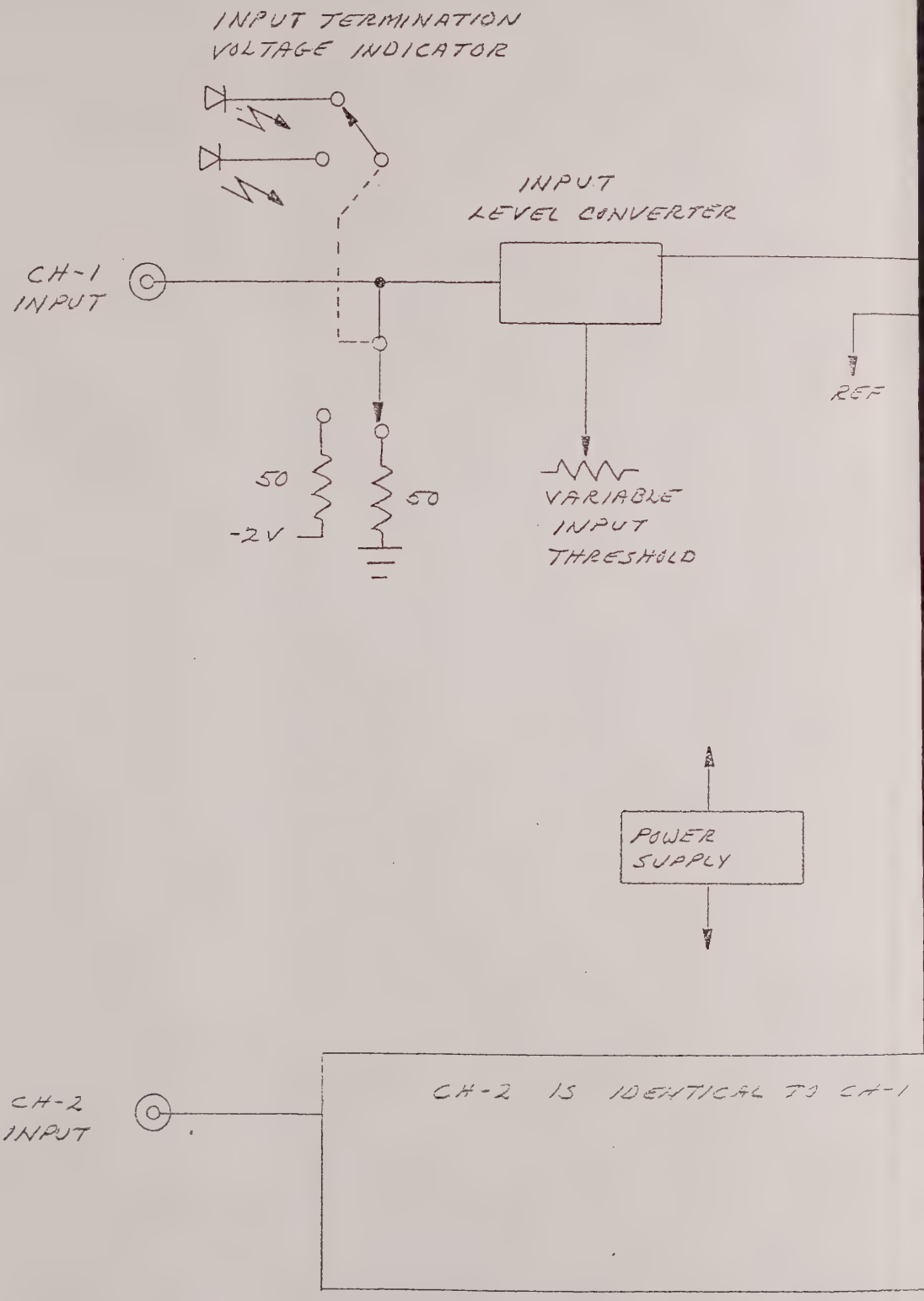
FRACTIONAL ± —	TITLE: MA-550 FUNCTIONAL BLOCK DIAG.		
ANGULAR ± —	DATE 7/11/78	DRAWING NUMBER TBN-54157	



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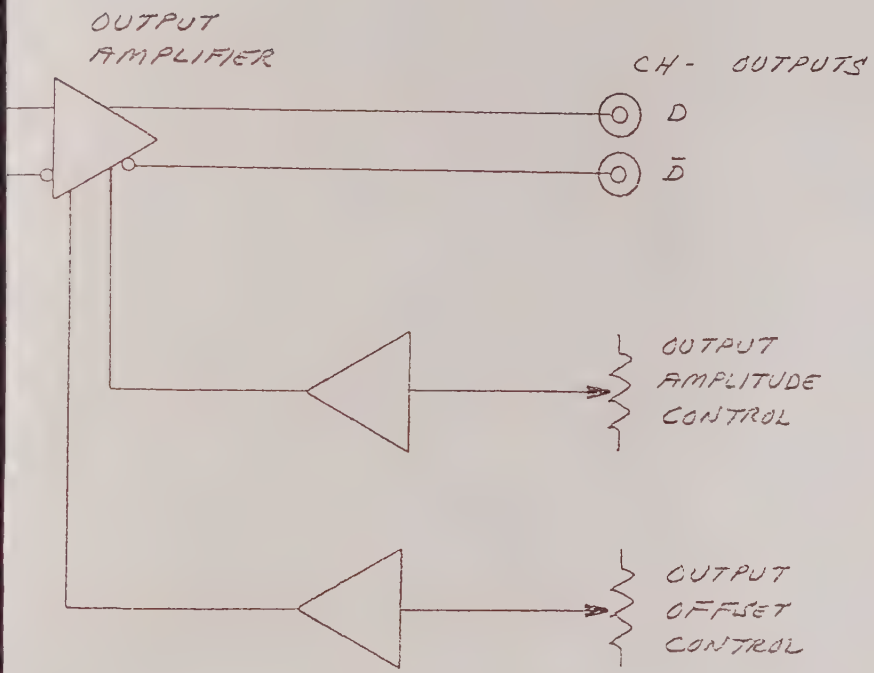


TOLERANCES (EXCEPT AS NOTED)	TAU-TRON, INC.		
DECIMAL ± —	TMI-SERIES	SCALE —	DRAWN BY BAC APPROVED BY
FRACTIONAL ± —	TITLE MA-550 FUNCTIONAL BLOCK DIAG.		
ANGULAR ± —	DATE 7/11/78	DRAWING NUMBER TBN-54157	

DATE	SYM	REVISION RECORD	DR	CK
4/1/78	1	REV PER ECN # 05385	JLC	

INPUT TERMINATION SWITCH (MOUNTED ON BD.)

F.P. LEDS — DS502 E4, E5, DS501 — 200 — -5.2V / -2V — 130 — 82 — INPUT (BNC) E2

2K — 1000pf — 2K — 3.9K — E1 15K — -12V — 27K — IC2 3403 — CW — R6 1K — 2K

F.P. INPUT BIAS ① +8V CW 5K -5.2V

47 mf (2) — 2K — 1000pf — 2K — 1M — 110 — 3.16K — IC2 340

1K

CHANNEL 1

CHANNEL 2

INPUT TERMINATION SWITCH (MOUNTED ON BD.)

F.P. LEDS — DS504 E12, DS503 E13 — 200 — -5.2V / -2V — 130 — 82 — INPUT (BNC) E10

2K — 1000 PF — 2K — 3.9K — E9 15K — -12V — 27K — IC7 3403 — CW — R12 1K — 2K

F.P. INPUT BIAS ① +8V CW 5K -5.2V

47 mf (2) — 2K — 1000 mf — 2K — 1M — 110 — 3.6K — IC7 3403

1K

+12V INPUT → +12V: 10mf @ 25V; LM340T-8 IC11 +8V REG; 1mF, .1mF, 10mF @ 25V → +8V

-12V INPUT → -12V: 10mf @ 25V; LM320T-5.0 IC12 -5V REG; 4.7mF, 10mF, .300 1/4W, 1mF, 1mF, 10mF → -5.2V

+8V — 10mf @ 25V — IC1 MA-550M mckt — 12, 11, 10, 9, 8, 7, 3, 2, 1

OUTPUTS (BNC F.P.) RG-178 D1, RG-178 D̄1

RG-178 D2, RG-178 D̄2

3.9K — 1.3K — -5.2V — 4.7mf — 10mf @ 25V (2) — -12V — 10m 1/2W — 1N4148

+8V — -5.2V — 62K — 10K — Q1 2N4403 — 100 — -12V — 5.1K — IC2 3403 — 20K

IC3 (MA759HC HEATSINK) — .01mf — +12V — 10K — 15K — -12V — R1 1K REF ADJ. — 10K — -5.2V CW

15K — R2 5K OFFSET COMP — 5.1K — CW

15K — CW — R3 5K AMP. COMP. ① — 5.1K

IC4 (MA759HC HEATSINK) — -12V — 8.2K — R4 5K AMP EOS ① — 7.5K — 5.1K

-5.2V — 10K — .01mf — +12V — 25K — 2K — OFFSET EOS ① — 7.5K — 8.2K

10m 1/2W — IC5 (MA759HC HEATSINK) — -12V

E3 — 1.1K — -5.2V — CW — 1K — AMP. CNTRL F.P. — E7

E8 — -7 — +8.1 — CW — 1K — OFF. CNTRL F.P.

IC6 MA-550M mckt — 12, 11, 10, 9, 8, 7, 3, 2, 1

OUTPUTS (BNC F.P.) RG-178 D2, RG-178 D̄2

3.9K — 1.3K — -5.2V — 4.7mf — 10mf @ 25V (2) — -12V — 10m 1/2W — 1N4148

+8V — -5.2V — 62K — 10K — Q2 2N4403 — 100 — -12V — 5.1K — IC7 3403 — 20K

IC8 (MA759HC HEATSINK) — .01mf — +12V — 10K — 15K — -12V — R7 1K REF ADJ. — 10K — -5.2V CW

15K — R8 5K OFFSET COMP — 5.1K — CW

15K — CW — R9 5K AMP COMP. ① — 5.1K

IC9 MA759HC HEATSINK — -12V — 8.2K — R10 5K AMP EOS ① — 7.5K — 5.1K

-5.2V — 10K — .01mf — +12V — R11 5K OFFSET EOS ① — 7.5K — 2K — 8.2K

10m 1/2W — IC10 (MA759HC HEATSINK) — -12V

E11 — 1.1K — -5.2V — CW — 1K — AMP. CNTRL F.P. — E14

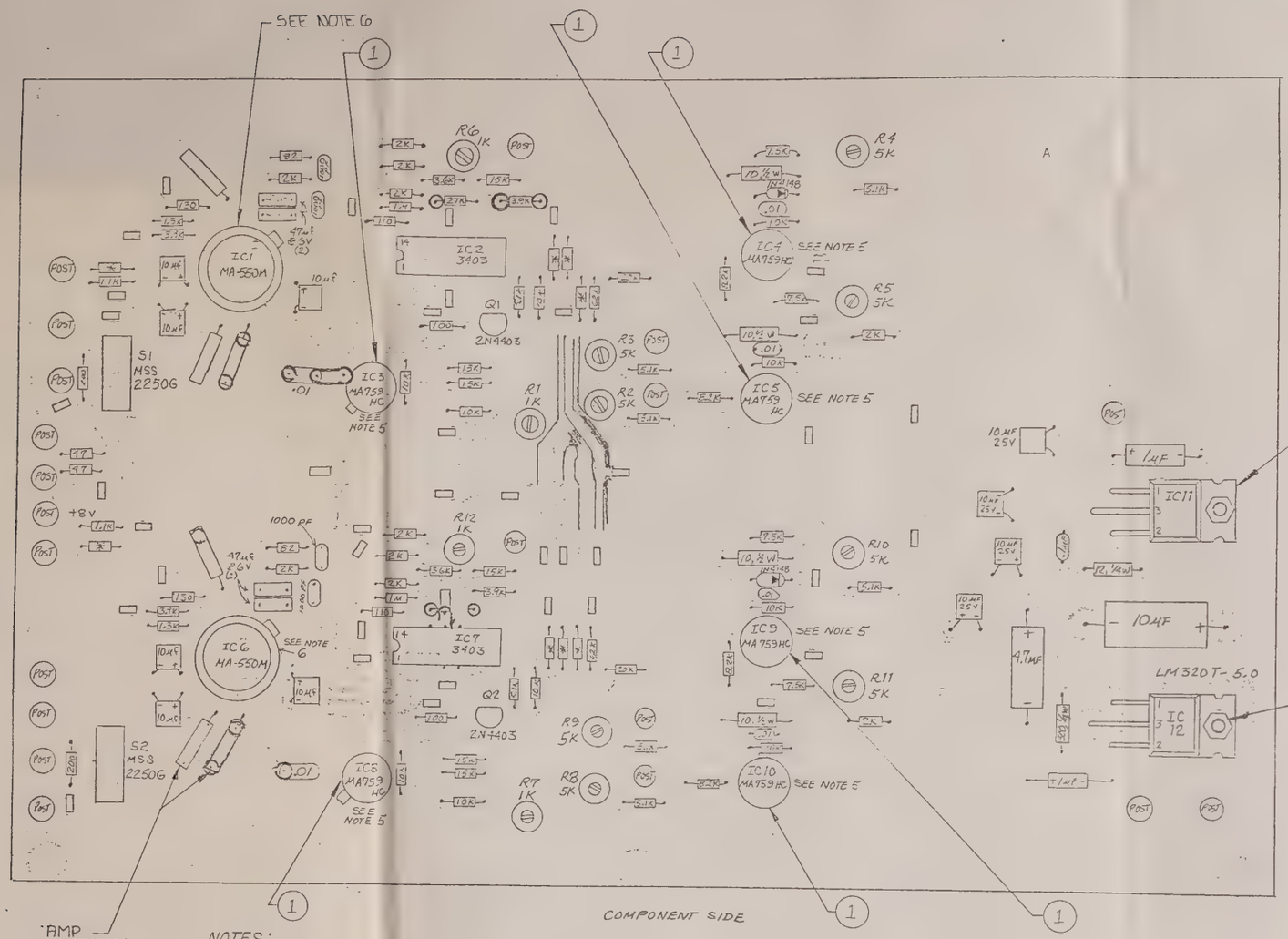
E15 — 47 — +8V — CW — 1K — OFF. CNTRL F.P.

NOTES:
1) UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE VALUES ARE IN OHMS ±5%, 1/4W
   b) CAPACITANCE VALUES ARE IN MICROFARADS.
2) ALL UNMARKED CAPACITORS ARE .01mf DECOUPLING CHIP CAPS.
3) * TO BE DETERMINED IN TEST.

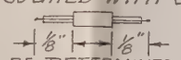
REF. DRWGS.
LOADING - TCK-54151
T.T. NO. - 0959

TOLERANCES (EXCEPT AS NOTED)	TAU-TRON, INC.	
DECIMAL ± —	TMI-SERIES	SCALE — DRAWN BY RAC APPROVED BY
FRACTIONAL ± —	TITLE MA-550 DUAL CHANNEL AMPLIFIER SCHEMATIC	
ANGULAR ± —	DATE 6/6/78	DRAWING NUMBER TDJ-54152 REV 1

	1	REV. PER DCN #00385 BAC	7/7/78	
	2	REV. PER DCN #00424 CS	11/10/78	BAC
	3	REV. PER ECO/01030 JAP 10 OCT 81	11-11-81	
	4	REV. PER ECO 01494 M.E.H 8/29/83	9/2/83	
	A	REV. PER ECO #01758 M.E.H 2-29-84	3-5-84	
	B	REV PER ECO # 01834 M.E.H 8-22-84	3-5-84	



NOTES:
1. UNLESS SPECIFIED OTHERWISE:
   A.) RESISTANCE VALUES ARE IN OHMS, ± 5%, ⅛ W.
   B.) CAPACITANCE VALUES ARE IN MICROFARADS.
2. ▭ DENOTES .01μf CHIP CAPACITOR.
3. ALL COMPONENT LEADS OVER ⅛" LONG MUST BE ▭ INSULATED WITH CLEAR TUBING.



4. * TO BE DETERMINED IN TEST.
5. IC 3, 4, 5, 8, 9, & 10 USE HEAT SINK, BIRTCHER # 3AL716-5GR.
6. IC 1, & IC 6 USE HEAT SINK "DELTA-T" # 215-AB & ANSLEY PINS, 12 PLACES EA.

AL MONTERIO 3-30-78

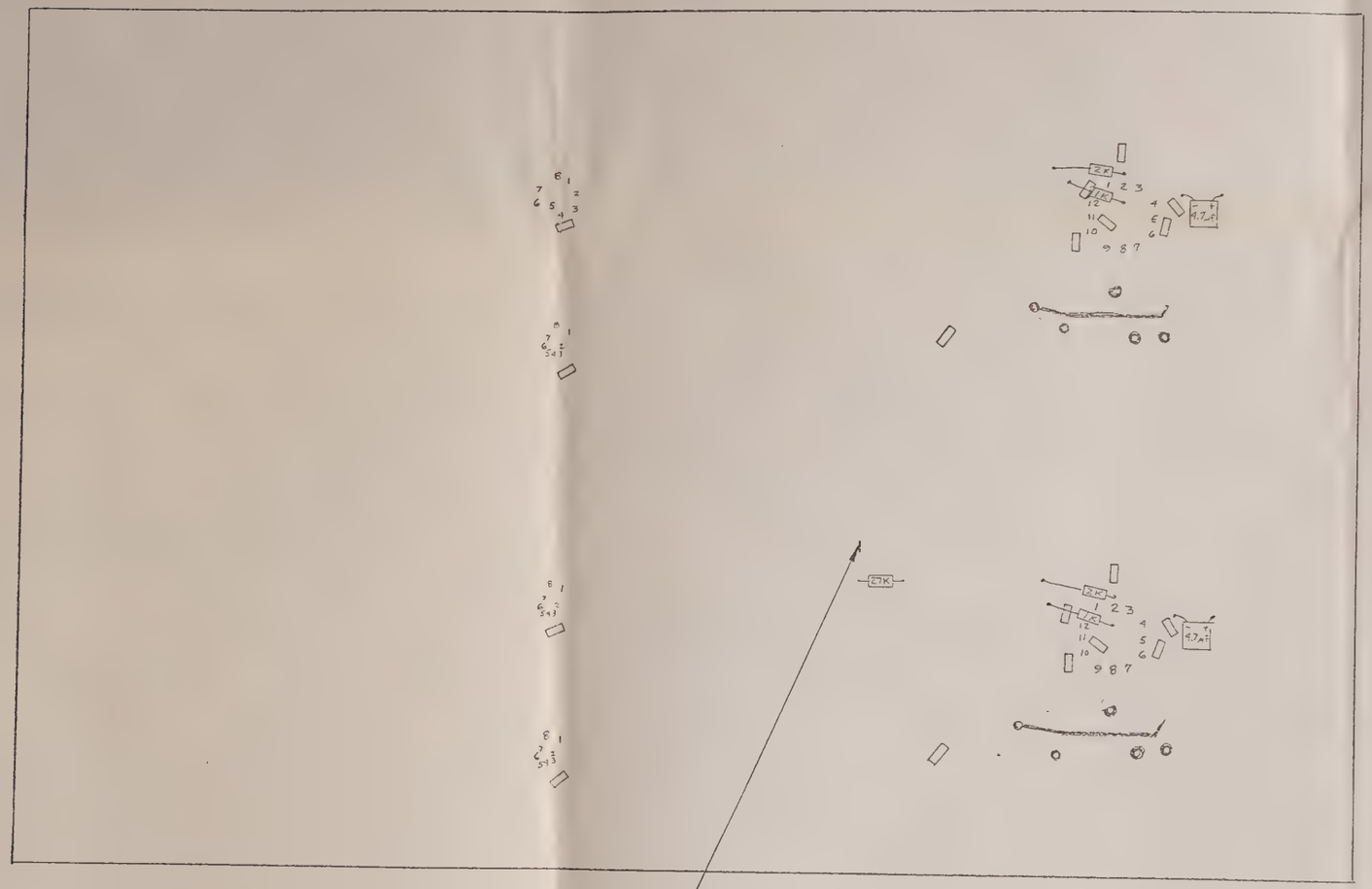
ASSEMBLY, MA-550 DUAL CHANNEL AMP PCB.

MA-550

TDK-54151 B

2/1 MA-550 1 2

SEE SHEET 1 FOR REVISIONS



NOTES:
(SEE SHEET 1)

AL MONTERIO 3-30-78

ASSEMBLY,
MA-550 DUAL CHANNEL AMP PCB

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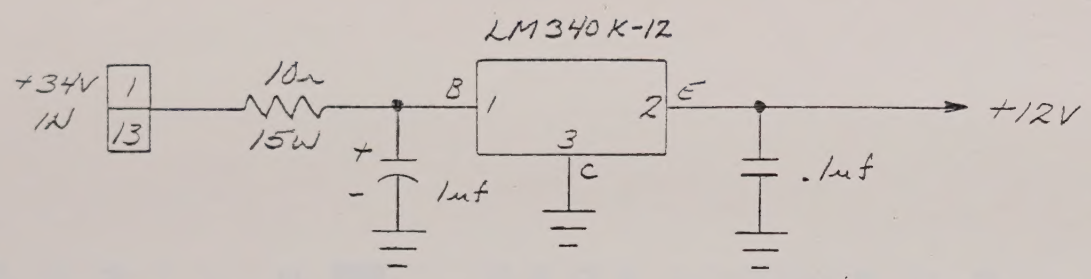
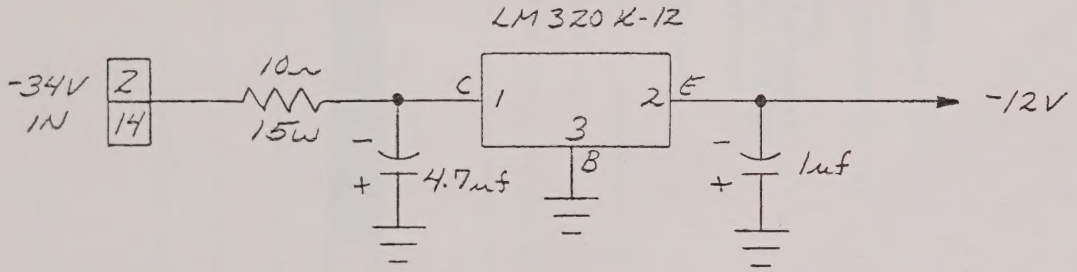
MA-550

2/1 MA-550 2 2

DATE	SYM	REVISION RECORD	DR.	CK.





TOLERANCES (EXCEPT AS NOTED)	TAU-TRON, INC.		
DECIMAL ± —	MA-550	SCALE —	DRAWN BY BAC APPROVED BY
FRACTIONAL ± —	TITLE +12V -12V POWER SUPPLY SCHEMATIC		
ANGULAR ± —	DATE 5/25/78	DRAWING NUMBER TAU-54148	

BRUNING 40-21

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If you have any feedback, please complete, detach, and mail the lower card

If you would like a representative to call, require additional information, or would like to be placed on our mail list to receive **The Pulse** or other useful technical information, please complete, detach, and mail the card below.

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☐ Add me to your mailing list.

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☐ TDM Voice/Data Multiplexers
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